DRAFT
GROUNDWATER INFORMATION SHEET

Dibromochloropropane (DBCP)

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The purpose of this groundwater information sheet is to provide general information regarding a specific constituent of concern (COC). The following information is pulled from a variety of sources and data relates mainly to drinking water. For additional information, the reader is encouraged to consult the references cited at the end of the information sheet.

GENERAL INFORMATION	
Constituent of Concern	Dibromochloropropane (DBCP)
Aliases	1,2-Dibromo-3-chloropropane, BBC 12, Fumagone, Fumazone, Nemabrom, Nemafume, Nemagone, Nemanax, Nemapaz, Nemaset, Nematocide, Nematox, Nemazone, OS1987, OxyDBCP
Chemical Formula	$C_3H_5Br_2Cl$
CAS No.	96-12-08
Storet No.	38761
Summary	The California Department of Health Services (DHS) regulates DBCP as a drinking water contaminant. The current State Maximum Contaminant Level (MCL) for DBCP, set by DHS, is 0.2 µg/L. Dibromochloropropane (DBCP) is an organic chemical that was used mostly as a soil fumigant for the control of plant parasitic nematodes. In California, it was used primarily in orchards and vineyards, but also on row crops, lawn grasses and ornamental shrubs. Based on DHS data through 2001, 394 of approximately 16,000 public drinking water wells (active and standby status) have had concentrations of DBCP ≥ 0.2 µg/L, with most detections occurring in Fresno, Stanislaus, and San Bernardino Counties.

REGULATORY AND WATER QUALITY LEVELS[1]		
Type	**Agency**	**Concentration**
Federal MCL	US EPA, Region 9	0.2 µg/L
State MCL	DHS	0.2 µg/L
Detection Limit for Purposes of Reporting (DLR)	DHS	0.01µg/L
Others: Public Health Goal (PHG) Preliminary Remediation Goal (PRG) – Tap Water	 OEHHA US EPA, Region 9	 0.0017 µg/L 0.0047 µg/L

[1]These levels generally relate to drinking water, other water quality levels may exist. For further information, see A Compilation of Water Quality Goals (Marshack, 2000).

SUMMARY OF DETECTIONS IN PUBLIC DRINKING WATER WELLS[2]	
Detection Type	**Number of Groundwater Sources**
Number of active and standby public drinking water wells[3] with DBCP concentration ≥ 0.2 µg/L.	394 of approximately 16,000
Top 3 counties having public drinking water wells[3] with DBCP concentration ≥ 0.2 µg/L.	Fresno, Stanislaus, San Bernardino

[2]Based on DHS data collected from 1984-2000 (Geotracker). See Figure 1.

[3]In general, drinking water from active and standby wells is treated or blended so consumers are not exposed to water exceeding MCLs. Individual wells and wells for small water systems not regulated by DHS are not included in these figures.

ANALYTICAL INFORMATION		
Method	**Detection Limit**	**Note**
US EPA 504.1, 551.1	0.01 µg/L	DHS approved for public drinking water systems
US EPA 524.2	0.05µg/L	DHS approved for public drinking water systems
Known Limitations to Analytical Methods	Sample must be cooled to 4° C upon collection and analyzed within 14 days. Sample should be free of air bubbles. Potential for interference with impurities contained in extracting solvents. Sample should be preserved with sodium thiosulfate to avoid the possibility of reactions that may occur between residual chlorine and contaminants present in some solvents.	

Public Drinking Water Testing Requirements	DHS established the DBCP MCL in July 1989, with associated requirements for quarterly monitoring, compliance determinations and treatment to come into compliance. In 1991, the US EPA adopted the same MCL and required monitoring. If contaminant levels are found to be consistently above the MCL, the water system must take steps to reduce the amount of DBCP so that it remains consistently below the MCL.

DBCP OCCURRENCE	
Anthropogenic Sources	DBCP was primarily used as a soil fumigant for control of parasitic nematodes, and was applied directly to soils in California between 1955 and 1977. This type of application was the largest source of DBCP release to the environment. In 1977, 831,00 pounds of DBCP was used in California alone. DBCP was used primarily in orchards and vineyards, but also on row crops, lawn grasses and ornamental shrubs. DBCP production in the USA during 1974-1975 was estimated to be 18 to 20 million pounds annually. Some industries use it to manufacture burn-resistant chemicals. The use of DBCP as a pesticide has been banned in California since 1977.
Natural Sources	DBCP is a manufactured chemical that does not occur naturally in the environment.
History of Occurrence	As of the year of 2000, DBCP at concentrations above the MCL was found in groundwater from 394 public drinking water wells (active and standby) and 166 abandoned/destroyed/inactive) wells in California, most of them in Fresno, Stanislaus, San Bernardino and Tulare counties. DBCP is the most frequently detected pesticide in California (USGS WSP 2468). In 1992-93, the concentration of DBCP in in Fresno well water ranged from 0.063 μg/L (the average of 21 active wells in the city limits) to 2.8 μg/L (inactive well) (OEHHA, 1999).
Contaminant Transport Characteristics	The mobility of DBCP in soil and groundwater can be described as high, with solubility in water of 1,270 mg/L at 20^{O} C and organic carbon partition coefficient (K_{OC}) between 1.5 and 2.6 (ref.3). These properties indicate a high potential to leach to groundwater. Because its density is greater than that of water, free phase of DBCP may sink to the bottom of the aquifer in the dense non-aqueous phase liquid (DNAPL) form. However, the application methods over wide areas and DBCP's high volatility should have prevented the creation of significant pools of DBCP.

	DBCP is not readily degraded in groundwater and its half-life in a Fresno aquifer was calculated to be from 6.1 years (ref.3), to 141 years (ref.4). No biodegradation was observed in aerobic soil columns after 25 days (ref.3).

REMEDIATION & TREATMENT TECHNOLOGIES	
Groundwater Remediation	DBCP may be removed from groundwater using a traditional pump and treat system. The only treatment method approved by the US EPA is granular activated charcoal together with packed tower aeration. Other innovative methods such as enhanced biodegradation or reactive barriers that remove halogenated chemicals from water may also be effective but they may not be practical because DBCP represents a non-point source type of contamination.
Drinking Water and Wastewater Treatment	Drinking water may be treated using various on-line treatment systems. Usually, air-stripping and granulated activated carbon are used to remove DBCP. Wastewater treatment plants use chemical oxidizers like potassium permanganate, and increasingly biodegradation processes to remove chlorinated hydrocarbons from water but the effect on DBCP is not documented.

HEALTH EFFECT INFORMATION

Acute/Chronic Effects: Breathing high levels of DBCP vapor can cause headaches, drowsiness, nausea, vomiting, abdominal cramps, diarrhea, lightheadedness, irritations to the eye, skin and respiratory system, central nervous system depression, and death. People exposed to DBCP above the MCL for relatively short period of time had kidney and liver damage and atrophy of the testes. Animals breathing high levels of the chemical were not able to reproduce and had damaged stomachs, livers, kidneys, brains, spleens, blood and lungs (ref.1).

Lifetime exposure to DBCP has the potential for kidney damage and male infertility (ref.4). DBCP can damage a male's ability to reproduce. Studies on workers have shown that men may produce fewer sperm, produce sperm that results in more female than male progeny, and eventually become unable to father children (refs. 1,4,5,).

DBCP is known to the State of California to cause reproductive toxicity, for purposes of the Safe Drinking Water and Toxic Enforcement Act of 1986 ("Proposition 65"). It was added to the list of reproductive toxicants in February 1987.

Cancer: Lifetime exposure to DBCP at levels above the MCL has the potential to cause cancer. DBCP is known to the State of California to cause cancer, for purposes of Proposition

65, having been added to the list of carcinogens in July 1987.

The California public health goal (PHG) for DBCP is calculated to represent a negligible risk of contracting cancer from the use of drinking water containing DBCP in the household environment over a lifetime. US EPA has classified DBCP as a probable human carcinogen in 1985 but removed its cancer assessment from the Integrated Risk Information System, stating that the assessment is "now under review".

KEY REFERENCES

1. Agency for Toxic Substances and Disease Registry (ATSDR). ToxFAQs for 1,2-Dibromo-3-chloropropane, September 1995. http://www.atsdr.cdc.gov/tfacts36.html

2. California Environmental Protection Agency / Regional Water Quality Control Board, Central Valley Region. August 2000. *A Compilation of Water Quality Goals*. Prepared by Jon B. Marshack. http://www.swrcb.ca.gov/rwqcb5/available_documents/wq_goals/wq_goals.pdf

3. Montgomery, J.H., Groundwater Chemicals Desk References, 3rd Edition, Lewis Publishers, 2000

4. California Environmental Protection Agency / Office of Environmental Health Hazard Assessment, Public Health Goal for 1,2-Dibromo-3-chloropropane. February 1999 http://www.oehha.ca.gov/water/phg/pdf/dbcp_f.pdf

5. US Environmental Protection Agency, Ground Water and Drinking Water. *Consumer Factsheet on: DIBROMOCHLOROPROPANE* http://www.epa.gov/safewater/dwh/c-soc/dibromoc.html (Oct. 23, 2002)

6. US Geological Survey. Pesticides in Surface and Ground Water of the San Joaquin-Tulare Basins, California: Analysis of Available Data, 1966 through 1992. Water-Supply Paper 2468.

FOR MORE INFORMATION, CONTACT:
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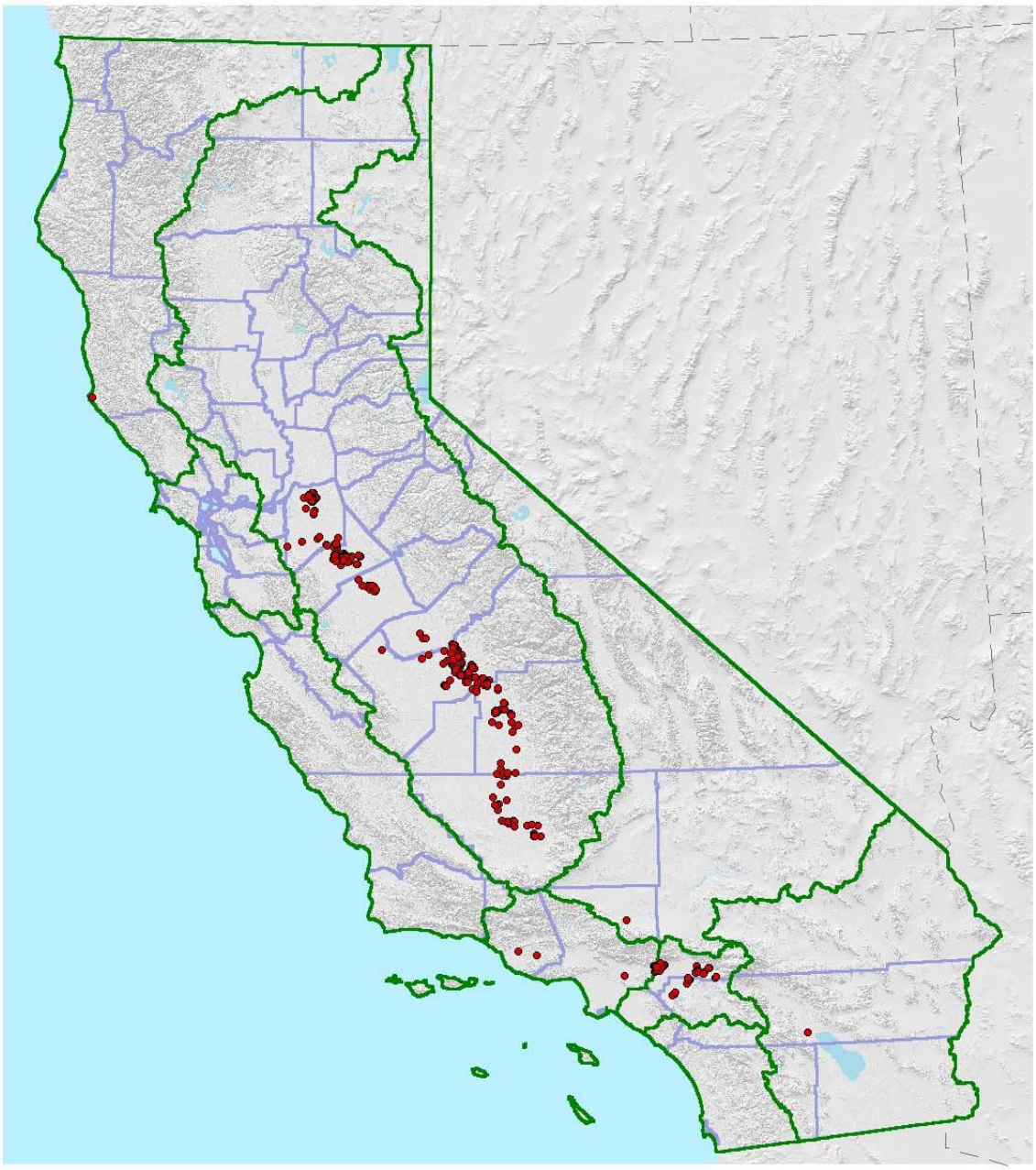
Groundwater Information Sheet: DBCP
Figure 1

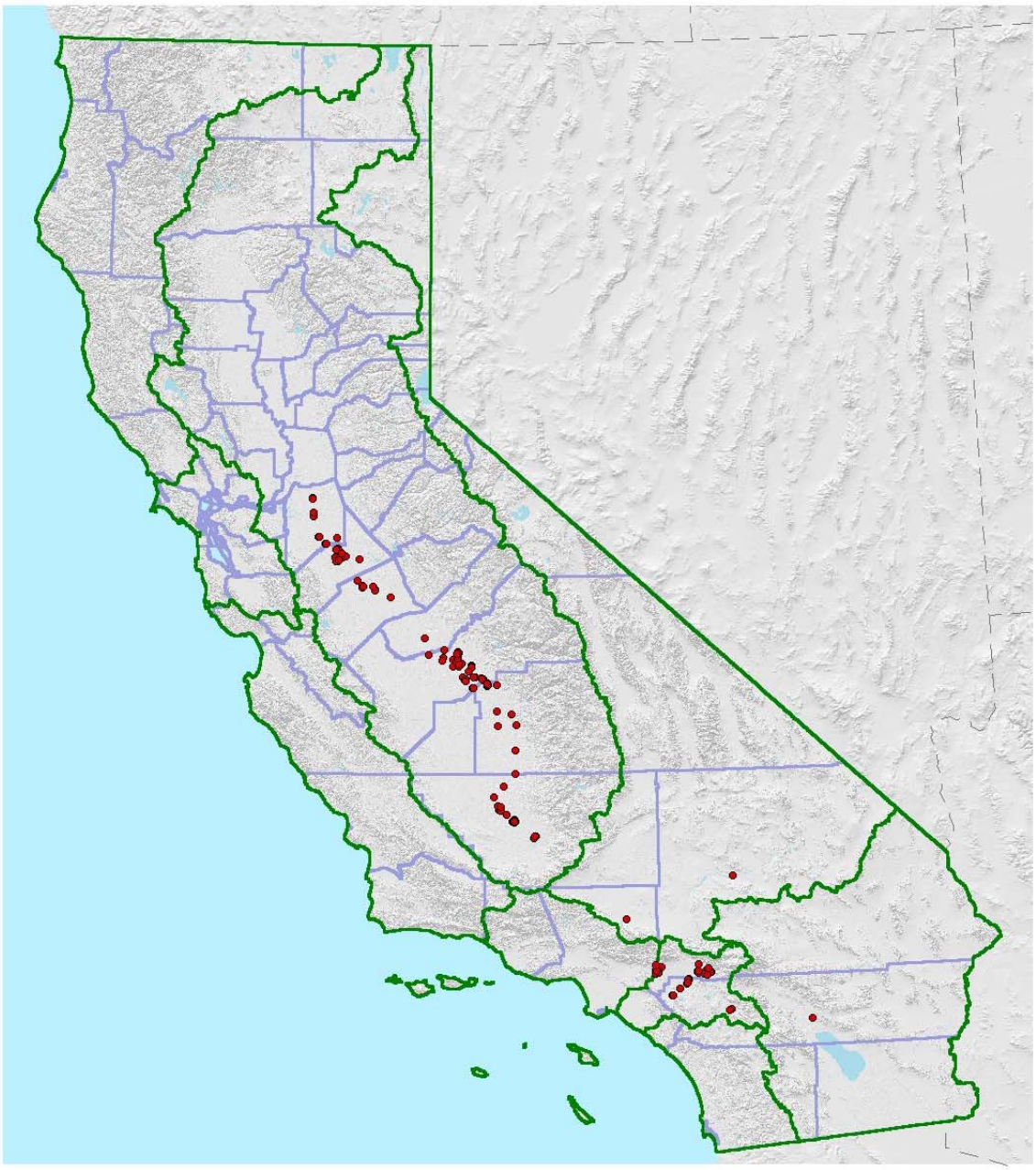


Active and Standby DHS Wells (394 Total) with at Least One Detection of DBCP >= 0.2 PPB MCL

Source: 1984 - 2000 DHS Data (Map Revised 10/02/02)
Prepared by: B. Wyckoff

GEOTRACKER

Groundwater Information Sheet: DBCP
Figure 2



Abandoned, Destroyed, and Inactive DHS Wells (166 Total) with at Least One Detection of DBCP >= 0.2 PPB MCL

Source: 1984 - 2000 DHS Data (Map Revised 10/02/02)
Prepared by: B. Wyckoff

GEOTRACKER